IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel. W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TURSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA,

Plaintiffs,

vs. 05-CV-0329 GKF-SAJ

TYSON FOODS, INC., TYSON POULTRY, INC., TYSON CHICKEN, INC., COBB-VANTRESS, INC., AVIAGEN, INC., CAL-MAINE FOODS, INC., CAL-MAINE FARMS, INC., CARGILL, INC., CARGILL TURKEY PRODUCTION, LLC, GEORGE'S, INC., GEORGE'S FARMS, INC., PETERSON FARMS, INC., SIMMONS FOODS, INC., and WILLOW BROOK FOODS, INC.,

Defendants.

VIDEO DEPOSITION OF HAILIN ZHANG, Ph.D.
TAKEN ON BEHALF OF THE DEFENDANTS
JANUARY 16, 2008, BEGINNING AT 9:00 A.M.
IN OKLAHOMA CITY, OKLAHOMA

REPORTED BY: Laura L. Robertson, CSR, RPR

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STATE'S EXHIBITS

STIPULATIONS

It is stipulated that the deposition of HAILIN ZHANG, Ph.D. may be taken on the JANUARY 16, 2007, pursuant to agreement and in accordance with the Federal Rules of Civil Procedure before Laura L. Robertson, CSR, RPR.

with land application?

A. Right.

Q. And I think you said soil samples, litter analysis, how to apply, when to apply and best management practices?

A. Right. Basically those are the components of nutrient management plan. So we try to help them how to develop a nutrient management plan, how to follow or understand nutrient management plans.

Q. Do you have an opinion about whether poultry litter, let's just talk about poultry litter, has an agricultural value to a farmer?

A. Yes, I do. Poultry litter contain nutrients, organic matter. So it is a beneficial by-product to agriculture.

Q. And I asked you about an agricultural value. Do you have an opinion about whether it has an economic value to a poultry grower?

A. Just to poultry grower?

Q. Or to someone who might use poultry litter on their land.

A. It depends on distance. If it is close enough, yes, there is economic benefits. If it has to be transported too far, they may lose that benefits.

Q. Have you ever attempted to calculate or do

whole state of Oklahoma?

A. I don't remember exactly.

Q. Well, as opposed to it being like for a specific watershed?

A. I knew for sure it is not by watershed.

Q. Okay. Have you ever attempted to calculate the value in terms of commercial fertilizer equivalencies of the nitrogen that's contained in poultry litter?

A. Yes, I did.

Q. And do you have any opinions in regard to that?

A. To the value of nitrogen in the poultry litter?

Q. Right. In terms of commercial fertilizer equivalency?

A. Yes.

Q. What is your opinion in that regard?

A. Poultry litter typically contains about 60 pounds of nitrogen per ton. Currently the nitrogen, commercial nitrogen, costs about 50 cents a pound. So that would be equivalent to close to $30 a ton, just for nitrogen.

Q. What about with regard to phosphorous, the same question with regard to phosphorous?

A. Yes, we can do the same calculation. Poultry litter contains about also 60 pounds phosphate per ton. Phosphate, it may cost about 40 cents a pound right now, I don't know exactly. It changes every day. So the value could be over 20 a ton for phosphorous.

Q. Have you ever attempted to calculate the cost of transporting poultry litter over any particular distance on a per mile basis or some other basis?

A. I have not. But somebody did calculation, I don't remember who did it. Estimated $2 per mile per Mack truck. That's some number stuck in my mind, but that's several years ago. Now the gas and oil price went up, probably that no longer holds.

Q. So you think that's probably gone up?

A. I think so.

Q. Do you have any idea who it was that prepared that information that you recall seeing, the two dollars per mile per Mack truck?

A. I don't recall.

Q. Was it someone at Oklahoma State?

A. I don't remember. Must be an economist.

Q. Okay. Do you know how long ago it was that you saw that, you said several years?

A. Yes, that's over five years ago.

Q. Okay. Do you have any estimate of how much a Mack truck would hold, how much litter?

A. 20 to 25 tons per truck.

Q. Does the weight of poultry litter vary?

A. Yes. Depending on the moisture content or how compact it is.

Q. Does it depend on what type of bird is being raised in the particular poultry house?

A. I think so. Also depend on the ratio of how much bedding material they use. Different birds may create some difference, too, like a lay hen might be different from a boiler chicken litter. But I don't have specific number for them.

Q. In your opinion, based on your experience of poultry litter, if one was attempting to calculate the tonnage of poultry litter in a particular area, would they have to account for these factors, moisture content and the type of bird and how compact it is and those types of factors you have listed?

A. No, they just need to analyze the litter, and then take the as-is value, so not correcting for moisture and other variabilities.

Q. Well, I guess my question is, for example, if someone is trying to calculate the amount of

poultry litter for an entire watershed, are these factors you have listed, moisture, compactness, type of different birds, are those things that ought to be accounted for in some fashion?

A. Yes, if they want to get accurate account, uh-huh.

Q. If growers in the Illinois River Watershed or anywhere in Oklahoma, could no longer use litter in any respect, land application of litter, do you have an opinion about what the value of poultry litter would be in that particular area at that point? Would it have any value?

A. To other farmers?

Q. Let's talk about economic value to the poultry grower, if that poultry grower can no longer spread the litter, does it any longer have any economic value for him?

A. No. If -- unless they find alternative use. They could use as an energy source or do something else to market it. Otherwise there is no value as a nutrient source, if they cannot apply.

Q. Are you aware of any current economically feasible alternative uses of poultry litter in Oklahoma, other than using it as a fertilizer, as it stands right now?

A. No, I'm not aware of any.

Q. We have talked about the cost of transporting it and some numbers that you saw quite some time back. Is there any such alternative use within what you would consider a reasonable distance to transport poultry litter from the Illinois River Watershed?

A. Well, Illinois River Watershed is a big watershed. I don't know where to start. But in my opinion, you should not transport more than 100 miles from the source. If you do, you may lose the value of that.

Q. And are you aware of any alternative sources of, or uses of poultry litter within 100 miles of that area, as you sit here right now? I know you haven't researched it.

A. Well, there are plenty of lands that actually need phosphorous, even in the Illinois River Watershed, or surrounding areas. They just need to test the soil, find out where the phosphorous is.

Q. So you believe that there are within the Illinois River Watershed other -- let's use a hypothetical. If I'm a poultry grower and my nutrient management plan does not allow me to put poultry litter on my particular farm, are you telling me that

BY MR. MCDANIEL:

Q. Good afternoon, Dr. Zhang.

A. Good afternoon.

Q. I'm Scott McDaniel and I'm an attorney and I represent Peterson Farms, Inc. My objective is going to be to not re-cover the same topics that you covered with Mr. Graves, but I may to a little bit extent jump around.

So I would appreciate a little patience bearing with me, because I want to hit on a couple of topics that you may have talked about, but maybe I have additional question or two that I would like to address.

Let me hand you what I have marked as Exhibit 9 to your deposition, and I pulled that down off of your web page at OSU, and I'm offering it. You and Mr. Graves have already talked about your educational experience and your background and your job titles at OSU, I just want to ask you if these three pages accurately reflect your work experience, your educational attainment and your position at Oklahoma State University.

(Exhibit 9 marked for identification)

A. Yes.

Q. All right. Go ahead and set that aside

then, thank you. You made a statement in the last few moments you were talking with Mr. Graves, and you said that you recommend that poultry litter be utilized as a fertilizer and applied at agronomic rates. Am I quoting you accurately?

A. Yes.

Q. All right. The poultry litter contains a number of substances that are beneficial to either plant life or to the soil. Would you agree?

A. I agree.

Q. Can you go through and list, I think we are all familiar with the, what are called the macronutrients or primary nutrients, nitrogen, phosphorous and potassium.

Beyond that, what are the additional components of poultry litter that are either beneficial to growing crops or the soil structure itself?

A. Well, plants need 16 essential nutrients to grow. Poultry litter contains all of these 16, including those macronutrients you mentioned, such as secondary nutrients, calcium, magnesium, sulphur, micronutrients, copper, zinc, iron, boron, manganese, carbon, hydrogen, oxygen. Those are -- plants can get from water and air.

Q. Right.

A. In addition, soil organic matter would improve soil quality and enhance plant growth.

Q. The organic matter that is in poultry litter?

A. Yes.

Q. In a general sense, what comprises the organic matter in poultry litter?

A. The building materials, whether it is wood shavings, sawdust, they are organic matters. The feces, urines do contain other organic compounds, too.

Q. All right. The compounds that you identified and you listed for us, those can be utilized by growing plants; is that correct?

A. The nutrients, yes.

Q. All right. But poultry litter improves the structure of soil and its ability to yield crops in a number of ways; is that true?

A. Yes.

Q. Can you describe what other mechanisms are at play that allow poultry litter to provide improvements to the soil structure?

A. By adding organic matter to the soil would improve soil structure. Poultry -- those organic matters also help retain more water, improve soil

moisture conditions.

So basically it is the rule of organic matter improving soil structure.

Q. All right. I have read some papers and I have seen the statement that organic fertilizer such as poultry litter improves the tilth, t-i-l-t-h, of soil. Can you tell us what that term means?

A. Tilth means, it is usually means to cultivate tilth. It has a bit of structure, like granule structure, it is easy to work with.

Q. Put in simple terms, if I was plowing the field, if it had good tilth, I could pull my plow through it easier and turn the soil easier, is that what you're suggesting?

A. Correct.

Q. Okay. So if you were -- if you take soil analysis of a field in order to evaluate whether to utilize poultry litter, or if so at what rates to utilize the poultry litter, is it conceivable that there could be plenty of copper or calcium in the soil, but the soil could be deficient in phosphorous or potassium and therefore the poultry litter could provide a benefit if it was applied?

MR. NANCE: Object to the form. Calls for speculation.

Q. (BY MR. MCDANIEL) It is a hypothetical. Do you understand my question?

A. Repeat it again.

Q. All right. Let me try approaching it in a way that maybe is clearer, if I'm being confusing.

If you want to raise a crop or forage, for instance, let's just say Bermuda grass, for example, since that's common in eastern Oklahoma and western Arkansas, is that true, is that a common pasture grass?

A. Yes.

Q. And as a soil scientist and your expertise in agronomy, you know in order to maximize the yield for Bermuda grass, the soil should have a certain chemical profile, there would be an optimal chemical profile to get the optimal yield; is that true?

A. Yes.

Q. All right. And what we are talking about today is, in nutrient management planning, we are trying to balance the desire to get the maximum yield against the need to protect natural resources from contamination. Is that from a policy standpoint, that's what your practice involves?

A. Correct.

Q. All right. All right, poultry litter you

said provides all 16 --

A. Nutrients.

Q. Nutrients?

A. Uh-huh.

Q. In our discussion, we have talked almost exclusively about phosphorous. And what the questions, or what I want to inquire about, sir, is it conceivable that poultry litter is meeting agronomic needs to improve the yield of that crop in some of the other 15 nutrients besides phosphorous; correct?

A. Correct. The plants can benefit any of the 16 if the soil cannot supply it. If you -- plants need a different amount of those 16 nutrients. If you base one nutrient to apply poultry litter, you may overapply some other nutrients.

Q. That's my point exactly. Now, in our discussion we have talked about phosphorous being that limiting nutrient for environmental reasons; correct? That's why we talk about phosphorous is out of concern for water resources?

A. Correct, for surface water quality.

Q. All right. If -- I'm trying to understand what agronomic rate really means in your business. If -- if you determined that the soil had sufficient potassium in the soil, therefore the potassium